DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
Washington, DC 20314-1000

CECW-EP

EM 1110-1-1000

Engineer Manual
No. 1110-1-1000

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# Engineering and Design
# PHOTOGRAMMETRIC MAPPING

**1. Purpose.** This manual presents procedural guidance, technical specifications, and quality control criteria for performing aerial photogrammetric mapping activities.

**2. Applicability.** This manual applies to all major subordinate commands, districts, and laboratories performing and/or contracting for aerial photography and photogrammetric mapping services in support of planning, engineering and design, construction, operation, maintenance, and/or regulation of civil works or military construction projects. This manual is also applicable to US Army Corps of Engineers (USACE) functional areas having responsibility for environmental investigations and studies, archeological investigations, historical preservation studies, hazardous and toxic waste site restoration, structural deformation monitoring investigations, regulatory enforcement activities, and support to Army installation maintenance and repair programs and installation master planning functions. Waivers from applicability should be requested by written memorandum to Headquarters, USACE (ATTN: CECW-EP).

**3. General.** The extensive planning and evaluation of data required to initiate most projects require the use of maps, photographic coverage, or both, as a means of presenting the needed data. Frequently, site plan maps for design or project condition use can be produced at less cost by using photogrammetric mapping methods. In other cases, photogrammetric mapping may be used to supplement conventional topographic surveying methods. Photogrammetric mapping techniques are also being extensively used to create spatial data bases, such as Computer-Aided Design and Drafting (CADD) files, Geographic Information Systems (GIS), Land Information Systems (LIS), and Automated Mapping/Facility Management (AM/FM) systems.

*a*. This manual presents in condensed form the general principles of photogrammetric mapping for guidance of individuals and organizations within USACE engaged in planning of mapping programs in connection with civil works or military construction design activities, including related CADD, GIS, LIS, and AM/FM applications. It includes a general outline and discussion of photogrammetric mapping principles and procedures, aerial cameras, stereoplotting instruments, and data mensuration and adjustment techniques. Photogrammetric textbooks and other handbooks are referenced for more detailed treatment of these basic concepts.

*b*. The primary intent of this manual is to establish definitive criteria standards, along with survey performance and procedural guidance, that will ensure uniform photogrammetric mapping

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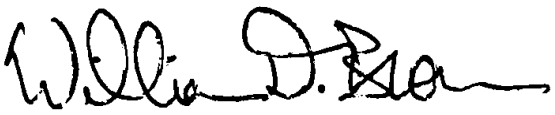
This manual supersedes EM 1110-2-1000, 7 January 1963

contract specifications, accuracy standards, and product deliverables throughout USACE. The manual is intended for direct reference in Architect-Engineer contract specifications where photogrammetric mapping is required. It is intended to be used in conjunction with Civil Works Construction Guide Specification CW 01335, Photogrammetric Mapping and Aerial Photography Services, which has been developed for preparing contract scopes of work.

*c*. A secondary intent of the manual is to provide guidance for USACE Project Managers in developing cost estimates for aerial photography and related photogrammetric mapping products. Since only a limited number of USACE Commands perform photogrammetric mapping in-house, and few project managers have actual experience in photogrammetry, cost estimating guidance in the manual has been developed. Methods for obtaining general budget estimates and detailed independent Government estimates for contract negotiation purposes are provided. In the future, automated cost estimating techniques may be developed for Corps-wide use.

*d*. A photogrammetric mapping project invariably involves problems peculiar only to that project, and the solution of those problems may not necessarily conform to the procedures outlined in this manual. In addition, photogrammetric mapping techniques and equipment, as in all fields of engineering, are rapidly changing. Impending use of NAVSTAR Global Positioning System (GPS) control and digital camera recording methods is expected to revolutionize current photogrammetric mapping methods, which, in turn, will impact many of the procedures, criteria, and cost estimating guidance contained in this manual. Therefore, for these and other reasons, USACE project managers involved in procuring photogrammetric mapping must strive to keep abreast of evolving technologies, and should consult with other more experienced USACE Commands when faced with complex or large mapping projects.

FOR THE COMMANDER:



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